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THE DEVELOPMENT OF KIT STUDENT WORKSHEET ON ACID BASE TO TRAIN SCIENCE PROCESS SKILL OF 11TH GRADE STUDENT

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Abstract

The study was aimed to know feasibility of kit student worksheet on acid base to train science process skill. The feasibility was assessed according theoretically and empirically feasibility. Theoretically feasibility obtained from validation result in content, presenting, language, and graphical criteria. Empirically feasibility obtained from student respond, appropriateness of lesson plan, and science process skill test. This research use 4-D Model of Development but implemented until develop phase. This research was tested to 16 students from *XI-MIA 2 SMAN 11 Surabaya* for two meetings with indicator and pH of acid base; and neutralization reaction as sub matter. Instruments in this research were validation, student respond, and observation sheet. Result of this research shown that kit Student Worksheet on Acid Base to train science process skill was feasible to use that proven with: 1) Result of theoretically feasibility with percentage range 73.33%-93.33%. (2) Result of empirically feasibility with percentage range of student responses was 81.25%-100.00% and all activities was appropriate with lesson plan. 3) Result of science process skill test was increased its proven by n-gain result for pretest 1-posttest 1 and pretest 2-posttest 2 was on category medium-high and the completeness percentage of science process skill components which on range 48,50%-98,50% in posttest 1 and 72,00%-100,00% in posttest 2.

Keywords: kit student worksheet, acid base, science process skill.

INTRODUCTION

Learning was defined as a process to teach students to reach learning objectives which has been planned, did, and evaluated. Moreover, learning process should be held interactively, inspirationally, pleasantly, challenging, able to motivate student to participate, actively, and give enough space to their initiative, creativity, and autonomy based on their talent, interest, and developing student physics and psychology [5]. Those will make learning process more effectively and understandably.

For that reason, learning material was needed to realize chemistry learning which teach the competences on curriculum. One of those was student worksheet. Student worksheet should contain title, basic competences, summary of matter, procedure, task, and report [2]. But in fact, chemistry teacher of *SMAN 11 Surabaya* state that it was hard to manage time for experiment activity while learning process occurred. So, it needed a simpler thing for minimization time to do experiment activity. *Kit* is an instrument box contained with tools and materials which used for experiment activity based on matter that learned [10]. *Kit* was expected to help teacher prepare the tools and material for experiment activity to support learning process. Moreover, usage of student worksheet and *kit* were expected to train student to balance their soft skills and hard skills which contained with affective, cognitive, and psychomotor aspects included science process skill.

One of competences that should be reached was science process skill. Science process skill was student ability to apply scientific method to understand, develop, and find their knowledge. Science process skill divided into three categories. Those are basic science process skill, advanced science process skill, and scientific attitudes and noble values [6]. Science process skill component that has been used in this research were observed, formulated problem, made hypothesis, and controlled variable for basic science process skill. Planned scientific investigation, made data table investigation, analyze data, and made conclusion for advanced science process skill. Those various components should be trained to make student recognize and customize scientific method which be used in investigation.

Chemistry teacher in *SMAN 11 Surabaya* said that, student was not accustomed to be trained science process skill activities, those make

student passive while learning process with investigation activity. It caused by the learning material which not supported enough to train science process skill. For their reason, the development of student worksheet which contain with investigation activity to train science process skill was needed for teacher to support learning activities.

Based on pre-study data from 20 students, the percentage students which are able to component observing phenomenon, formulate problem, making hypothesis, and controlling variables each were 31.25%; 23.44%; 17.19%; 21.88%. Then percentage student which were able to plan scientific investigation which included list the tools and materials which used and make procedural to do the investigation, each has 40.63% and 31.25%. For collecting data, analyzing data, and making conclusion, were respectively 12.50%; 12.50%; 17.19%. Those percentages prove that science process skill of student was low and needed to train more.

Pre-study data also showed that 56.30% students was consider acid base as difficult matter in chemistry. Students consider that less media for learning and rarely have experiment activities were causes this problem. The interview data was supported that. Acid base matter was hard enough to learn, for acid base properties sub matter, it is easily to teach with conventional method, but for the other sub matters was hard enough too learned without demonstration and experiment activities. In order to that, so *kit* student worksheet on acid base to train science process skill developed to help teacher and student apply an experiment while train science process skill.

METHOD

This research is development in educational aspect which refers to 4-D Model of Development by Thiagarajan and Semmel. There 4 phase in the 4-D model, which are: define, design, develop, and disseminate [9]. But in this research just implemented until develop phase. Subject of this research was 16 students from *XI-MIA 2 SMAN 11 Surabaya*.

Instrument for this research is review sheet, validation sheet, questionnaire student responses sheet, student activities observation sheet, and test of science process skill sheet. Method which used was observation for student activities observation sheet; questionnaire for review, validation, and student responses sheet; test for science process skill test of student.

Review sheet was analyzed qualitatively to know review which suggested by reviewer of kit student worksheet. The result will produce draft II as revision from draft I which has been reviewed.

Percentage of validation data obtained based on validation sheet which assessed with one lecturer and two chemistry teachers. Data was analyzed using Likert scale which present in Table 1.

Table 1 Likert Scale

Value Scale	Category
5	Not Feasible
4	Less Feasible
3	Feasible Enough
2	Feasible
1	Very Feasible

[7]

The result calculated with formula (1):

$$P(\%) = \frac{total\ score\ of\ data}{Category\ score} x100\% \quad (1)$$

With description:
P(%)= percentage (%).
Then the percentage which obtained was interpretative using Likert interpretation as follows in Table 2:

Tabel 2 Interpreting score

Percentage (%)	Category
0-20	Not Feasible
21-40	Less Feasible
41-61	Feasible Enough
61-80	Feasible
81-100	Very Feasible

[7]

Kit student worksheet will be theoretically feasible if it has percentage ≥61% in content, presenting, language, and graphically criteria [7].

Questionnaire student responses was analyzed using Guttman scale that shown in Table 3:

Table 3 Guttman Scale

Scale	Answer
1	Yes
0	No

[7]

Student answer "yes" or "no" based on the aspects which written in questionnaire sheet. Those aspects are represents of student opinions about kit student worksheet that they used. Result which obtained will calculate with formula (2):

$$P(\%) = \frac{\sum Y}{\sum MY} x100\% \quad (2)$$

With description:
P(%) = percentage(%)
∑Y = total of "yes" answer
∑MY = total of maximum "yes" answer
Interpretative of obtained percentage will be concluding in descriptive statement with Interpretation as follows in Table 2. Based on Table 2, kit student worksheet will be empirically feasible if it has percentage ≥61% for questionnaire student responses in content, presenting, language, and graphically criteria [7].

The appropriate of lesson plan was analyzed using Guttman scale as follows in Table 3. Observer was gave check sign for "Yes" column if the activity aspect was appropiate. The appropriate of lesson plan will shown the usage of *kit* student worksheet in learning activity. If all of activities in lesson plan was appropriate, it shown *kit* student worksheet was good to implemented in learning process to train science process skill.

Student activities observation analyzed using Guttman scale as follows in Table 3. Observer was observing the dominant activities which are written in student activities observation sheet in a group. Then the result of student activities observation calculates with formula (3):

$$Activity(\%) = \frac{time\ total\ of\ activity}{time\ total\ of\ learning\ process} x100\% \quad (3)$$

Then, for science process skill test to know the result science process skill of student which has implemented with kit student worksheet of acid base. There were three tests in amount, pretest, posttest 1, and posttest 2. The result calculates with formula (4):

$$Score = \frac{\sum score\ of\ right\ answer}{\sum maximum\ score} x4 \quad (4)$$

Then it converted in scale 0-100 as follows in Table 4.

Table 4 Score Conversion

Score		Predicate
In 0-4 Scale	In 0-100 Scale	
3,85-4	96,25-100	A
3,51-3,84	87,75-96	A-
3,18-3,50	79,5-87,5	B+
2,85-3,17	71,25-79,25	B
2,51-2,84	62,75-71	B-
2,18-2,50	54,5-62,5	C+
1,85-2,17	46,25-54,25	C
1,51-1,84	37,75-46	C-
1,18-1,50	29,5-37,5	D+
1,00-1,17	25-29,25	D

Minimum score which implemented for chemistry lesson in *SMAN 11 Surabaya* was 75. So, students should make a total score ≥ 75 for science process skill test to has individual completeness.

The difference score between pretest and posttest was analyzed by using n-gain. N-gain used to know successful standard of kit students worksheet of acid base to implemented science process skill of student. Data calculated with formula (5):

$$n-gain = \frac{posttest\ score - pretest\ score}{maximum\ possible\ score - pretest\ score} \quad (5)$$

Then it interpreted based on Hake criteria on Table 5.

Table 5 Hake Criteria of N-Gain

N-Gain	Interpretation
n-gain>0,7	High
0,3<*n-gain*≤0,7	Medium
n-gain≤0,3	Low

[4]

RESULTS AND DISCUSSIONS

Data which obtained in this research were validation data, student respond data, and result of science process skill test of student. Validation data was obtained to know the theoretically feasibility. Validation data was obtained in develop step after reviewed. *Kit* student worksheet given advice by three reviewers, two lecturers and one chemistry teacher, to content, presenting, language, and graphically criteria. Furthermore, from the results was revised and form draft II. Draft II validating by one lecturer and two chemistry teacher. Validator assess with choose the very suitable score for each criteria in validation sheet. Validation data was prove on Table 6.

Table 6 Validation Data

Criteria	Percentage (%)	Category
Content	88.00	Very Feasible
Presenting	87.99	Very Feasible
Language	83.33	Very Feasible
Graphically	89.52	Very Feasible

Based on Table 6 Validation data, prove that all criteria of validation has reached percentage ≥61% which at very feasible category. Content category has 8 aspects which are represent content of *kit* student worksheet assessment. For the first, second, and third aspect of content criteria was shown that *kit* should has suitability with learning material such as the concept should be suitable with curriculum [2]. The forth aspect was shown that the matter and phenomenon has been represent the matter which learned.

The fifth, sixth, and seventh aspect was assessed for suitability of laboratory activities with matter and component of science process skill. The score which obtained prove that worksheet has been suitable in content of laboratory activities, matter, and component of science process skill. This worksheet was divided into three activities, pre-laboratory, laboratory, and post-laboratory activity to trained science process skill in order and easily. Indeed science process skill should be directly trained through experiences [1]. Learning activities which teach in affective, cognitive, and psychomotor will interest student to solve the given problem and trained student with science process skill [8]. The eighth aspect was shown that *kit* has educational value such as can to improve scientific attitudes of students [3]. Those explain that percentage which obtained of content criteria was 88.00% with very feasible category.

The presenting has average percentage 87.88% in very feasible category. There were 7 aspects in presenting category. Presenting matter, figure, the systematically matter in worksheet, aesthetic of *kit*, function of *kit* in learning process, safety and the easily use of kit. The lowest score was on figure of worksheet. It because the figure was not communicative enough, so it should be revised. The good figure for student worksheet will extend the information and content of it effectively [1]. For the other aspects has a good percentage with very feasible category.

Language criteria had two aspects which use easy term and explicit language. The average percentage was 83.33%. The validator assessed with score 3 for use easy term aspect. They also give suggestion to revise the language of student worksheet in term to make it more communicative and understandable. The easy term and explicit language will make student worksheet easier to use [2].

Graphically criteria has three aspects, which are using interest and representable cover for student worksheet, use the correct font size and font type, also the suitability of student worksheet layout. The good combination in figure and font which be able to extend the information was the suitability of layout in quality assessment of student worksheet [4]. The average percentage of graphically criteria was 89.52% with very feasible category.

Based on the percentage which obtained in content, presenting, language, and graphically criteria, *kit* student worksheet was theoretically feasible with percentage range 83.33%-89.52% in very feasible category.

Then for empirically feasibility which obtained from student respond questionnary, appropriateness of lesson plan, and the result of science process skill test. First was student respond which obtained after test on second day. Respond was given to know the student opinion after using *kit* student worksheet in learning activity. Table 7 prove student respond data.

Table 7. Student Respond Data

Criteria	Percentage (%)	Category
Content	96.88	Very Feasible
Presenting	92.41	Very Feasible
Language	90.63	Very Feasible
Graphically	95.83	Very Feasible

Based on Table 7, the average percentage of student respond for content criteria was 96.88% with very feasible category. Based on the four aspects in content criteria, it can conclude that student worksheet which developed was easily to use and the content was suitable with learning acitivy.

Presenting criteria has fourteen aspects which has average percentage 92.41% with very feasible category. The percentage was shown that *kit* student worksheet has science process skill component which suitable with submatter in worksheet. The worksheet activity was supported by *kit* which provided tools and materials to do the activity [3]. But tools and materials on *kit* were not named and make student confuse. For language criteria which has percentage 90.63% with very feasible category. The percentage shown that student has a good respond with *kit* student worksheet. Aspects in language criteria was represented the feasibility of worksheet for language criteria that are readable, the explicitness of information, the suitability with the rule, and using an effective language [2].

The graphically criteria which has 95.83% with very feasible category, prove that cover of worksheet can interest student to study and font which used in worksheet was make the student comfort while using the worksheet. Worksheet will given a maximal effect to help student to study while the worksheet has a good layout which make it comfort to readable and present the matter well [4].

The appropriateness of lesson plan was the empirically feasibility too. Based on observation data during test, all activities was appropriate with lesson plan. It was assesed by four observers. The

result has proven that all activities while implement the student worksheet and train science process skill had been done. Data observation of student activity was supported it. For the first meeting, the time while student did the relevant activity such as listen the teacher, observe, did the investigation, has percentage 96.60%. Then for second meeting was 94.89%. It prove that each group has the dominant relevant activities during learn.

Data of pretest and posttest was analyzed by n-gain. If the category of n-gain was on medium and high, it prove that *kit* student worksheet can used in learning activity moreover to train science process skill. Based on data, student was on medium-high category of n-gain for the first and second meeting. Pretest was be held once, but it divided into two based on its component of science process skill which train in first and second meeting. Components of science process skill which trained in first meeting was observation, design the scientific investigation, make table of scientific investigation data, analyzed, and make conclusion. Then for the second meeting was formulated problem, made hypothesis, controlled the variables, designed the scientific investigation, made table of scientific investigation data, analyzed, and made conclusion.

Student score for pretest 1 was on range 10.00-30.00 and for pretest 2 was 14.29-39.29. Some component of science process skill on pretest was not be answered by student because they feel confused to fill the test. The result of posttest 1 is shown the science process skill of student after trained with *kit* student worksheet. Their score was increased with range 60.00-75.00. The n-gain 1 shown medium-high category which mean *kit* student worksheet be able to train science process skill of student. Posttest 2 has range 75.00-96.40 which has dominancy high category on n-gain 2. The score of posttest 2 was increased because student was start accustomed with component of science process skill. The more often trained science process skill, the more accustomed student. Student worksheet which used to train science process skill should make with some stage for one matter. Therefore, student will more trained and can learned from their past [11].

CLOSURE

Conclusion

Based on suitability of data result and discussion with problems of the research, so it can be concluded that kit student worksheet was feasible to use which proven with:

1. Kit student worksheet of acid base to trains science process skill of 11th grade student based on content, presenting, language, and graphically criteria were theoretically feasible based on validation data result which has percentage range 70.00%-100.00%.
2. Kit student worksheet of acid base to trains science process skill of 11th grade student based on content, presenting, language, and graphically criteria were empirically feasible based on result of questionnaire student responses which has percentage range 81.25%-100.00%.
3. Result of science process skill test has improved from pretest 1-posttest 1 and pretest 2-posttest 2 with medium-high n-gain category. Completeness percentage range of science process skill components in posttest 1 was 48.50%-98.50% and 72.00%-100.00% in posttest 2.

Suggestion

Suggestions that can be given for the next research were:

1. 4-D Development Model which used just implemented until Develop phase, so for the next research expected to implement until Disseminate phase.
2. This research was be done in twice meeting, so for the next research expected to train science process skill in a longer time. Science process skill component which train in longer time can build a good habit of students to be skillful in components of science process skill.
3. Student knowledge of tools and materials should be notices for the next research because it was important when student do laboratory activities. Future research expected to give list of tools and materials in kit box, moreover give MSDS of materials that used in kit box was suggested as given materials knowledge of students.

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